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A Case Report of Ulnar Osteotomy for the Treatment of Monteggia Fracture in a Child

Wenrong Yang, Jincai Liu, Shuchun Yang, Jianping Li, Dan Wang*

Chuxiong Yi Autonomous Prefecture Hospital of Traditional Chinese Medicine, Chuxiong Yi Autonomous Prefecture 675000, Yunnan, China

**Author to whom correspondence should be addressed.*

Abstract: Monteggia fracture-dislocation is a rare and complex injury that typically involves an ulnar fracture combined with a dislocation of the proximal radioulnar and radiocapitellar joints. Ulnar osteotomy is an effective treatment method. This article reports a case of chronic Monteggia fracture in an 11-year-old male patient successfully treated with a simple proximal ulnar osteotomy.

Keywords: Monteggia fracture; Ulnar osteotomy; Chronic fracture

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1. Introduction

Monteggia fracture-dislocation is a rare and complex injury that usually involves an ulnar fracture combined with a dislocation of the proximal radioulnar and radiocapitellar joints. These injuries account for less than 1% of pediatric forearm fractures and primarily occur in children aged 4–10 years. Due to the unique physiological anatomy of the pediatric elbow joint and the lack of awareness of this condition among non-pediatric orthopedic specialists, many children with Monteggia injuries are often misdiagnosed early on. The condition develops into a chronic Monteggia fracture and is only diagnosed after corresponding symptoms appear. On August 4, 2023, the Traditional Chinese Medicine Hospital of Chuxiong Yi Autonomous Prefecture admitted a child with a chronic Monteggia fracture. The patient was treated with a simple proximal ulnar osteotomy and plate internal fixation, achieving favorable therapeutic effects. The case is reported as follows.

2. Clinical data

An 11-year-old male patient, height 145 cm and weight 37 kg, was injured while playing football at school on July 21, 2023, at 17:00. The injury involved his left elbow, and he immediately felt pain and swelling in the left

elbow area, with limited movement. There were no symptoms of headaches, chest pain, or abdominal pain. The patient was taken to a local hospital by his family for inpatient treatment. The local doctor considered a left ulnar beak fracture and recommended manual reduction and plaster fixation for conservative treatment. One week after treatment, the patient was discharged. On August 4, 2023, the patient returned to the hospital for a follow-up x-ray, which indicated dislocation of the left radial head. The patient was then transferred to our hospital for treatment. Physical examination upon admission revealed swelling on the lateral side of the left elbow, tenderness on the anterolateral aspect of the elbow joint, and a palpable radial head protruding forward. The left elbow joint exhibited normal extension, with a flexion angle 10° smaller than the right side. Distal blood supply and sensation were intact. Auxiliary examination: The DR examination revealed a dislocation of the left radial head, while the right humeroradial joint was in good alignment. An MRI of the right elbow joint revealed injuries to the brachialis muscle, flexor digitorum profundus, and surrounding subcutaneous soft tissues of the left elbow joint, with no incarcerated objects in the proximal radioulnar joint (see **Figure 1**). Admission diagnosis: left Monteggia fracture (Bado type I).

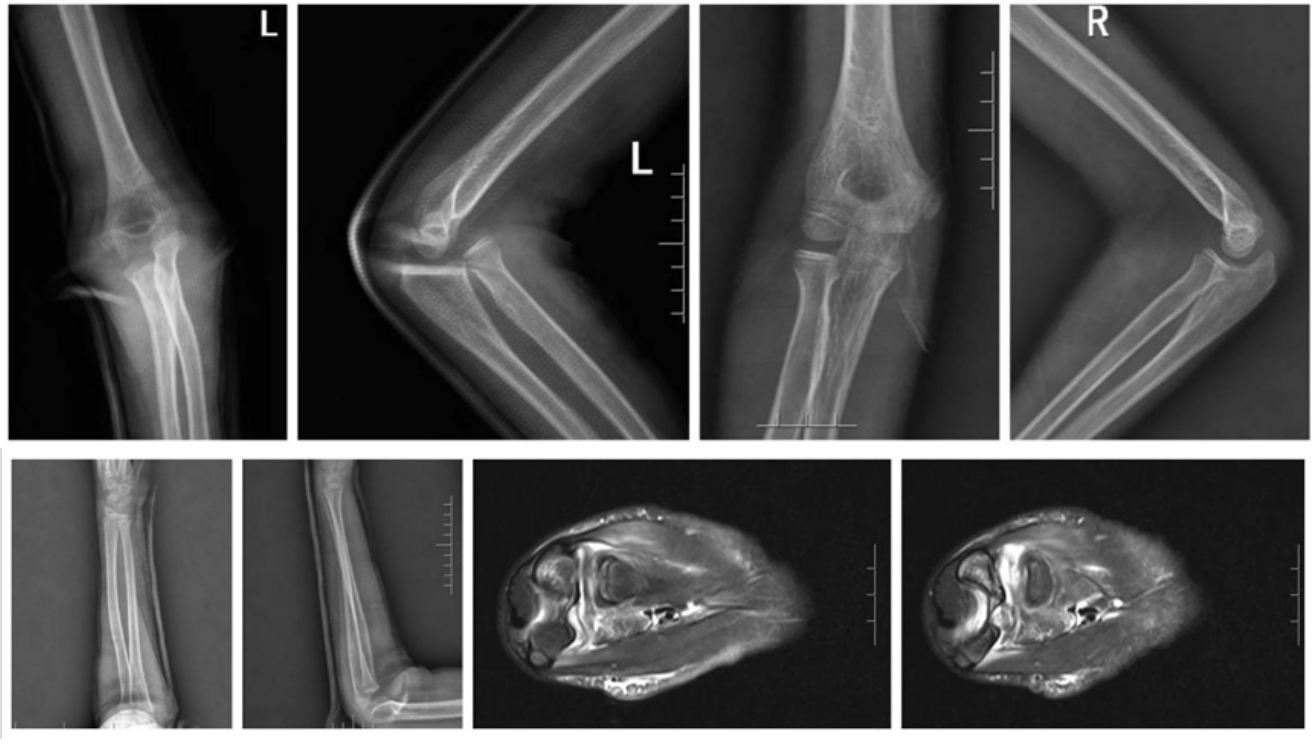

Figure 1. Preoperative radiograph of the left elbow.

Figure 1 shows an anterior dislocation of the left radial head, a left ulnar angulation fracture, and a normal right humeroulnar relationship before surgery.

On August 8, 2023, a proximal ulnar osteotomy was performed on the left side under general anesthesia. The surgical steps were as follows

(1) The ulnar angulation fracture was reduced using the apex of the ulnar curvature as the fulcrum, but the ulnar deformity could not be corrected.

(2) 1 ml of iohexol injection was injected into the left elbow joint cavity. C-arm fluoroscopy showed no soft tissue incarceration in the humeroulnar joint. The dislocated radial head was reduced by flexion and

supination manipulation, but the reduction failed.

(3) A longitudinal incision, approximately 5 cm long, was made on the posterolateral aspect of the proximal left ulna.

The proximal ulnar shaft was exposed in order, and a large amount of bony callus was observed surrounding the proximal ulna. Some of the bony callus was removed. Under C-arm fluoroscopy, the proximal ulnar osteotomy site was marked. After drilling with a Kirschner wire at the osteotomy point, a transverse ulnar osteotomy was performed using a bone knife. The forearm was supinated, and the elbow joint was flexed to the extreme. C-arm fluoroscopy revealed a good reduction of the radial head. The ulnar osteotomy ends were fixed with a set of bone plates and screws. Finally, under C-arm fluoroscopy, the radial head was well-aligned in flexion-supination, flexion-pronation, extension-supination, and extension-pronation (see **Figure 2** for details). After confirming no abnormalities in passive elbow joint movement, the surgical field was routinely irrigated and closed layer by layer. Finally, the left upper limb was immobilized with a plaster cast in 100° flexion and supination.

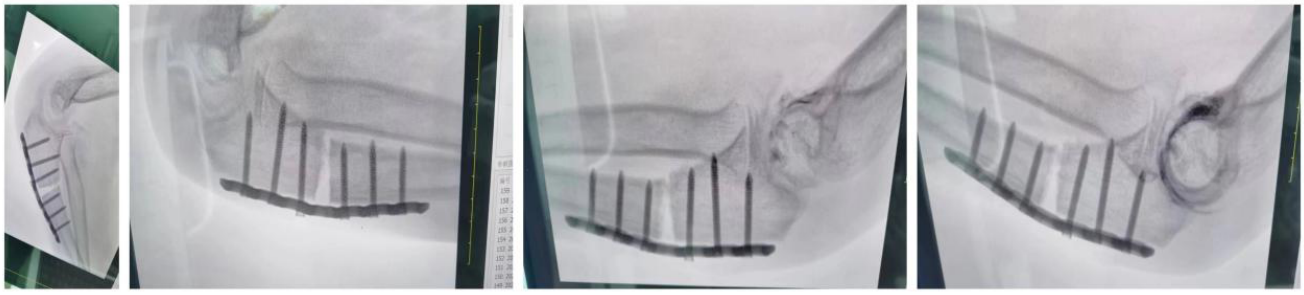

Figure 2. Postoperative radiographic alignment of the humeroulnar joint following proximal ulnar osteotomy.

Figure 2 shows good alignment of the humeroulnar joint in extension-supination, extension-pronation, flexion-supination, and flexion-pronation after proximal ulnar osteotomy and internal fixation during surgery.

On the second postoperative day, X-ray reexamination revealed suboptimal alignment between the radial head and the humeral head, with slight upward displacement of the radial head. The plaster cast was changed to immobilize the left upper limb in 120° flexion and supination. X-ray reexamination showed good humeroulnar alignment (see **Figure 3**).

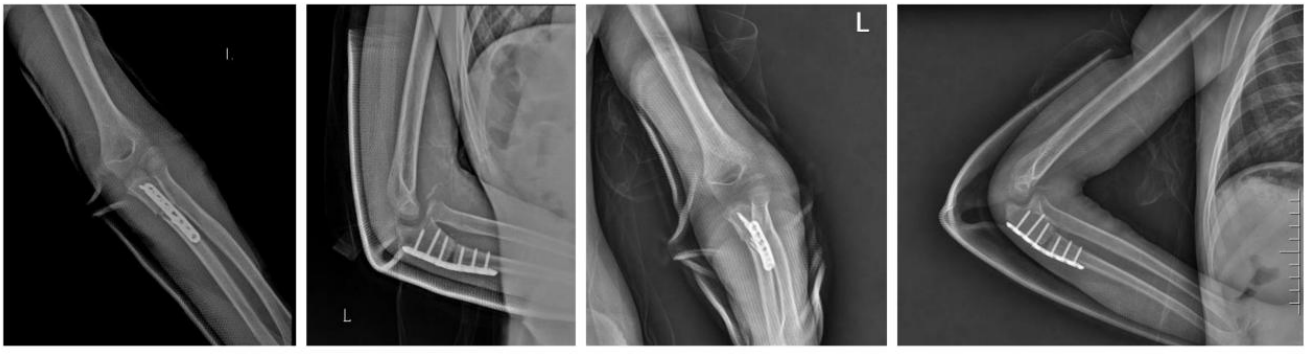

Figure 3. Radiographic Demonstration of Subluxation Reduction Following Immobilization Adjustment.

Figure 3 shows suboptimal alignment between the radial head and the humeral head, with slight upward

displacement of the radial head on postoperative reexamination. After changing the plaster cast and adjusting the immobilization position, excellent humeroulnar alignment was achieved.

Six weeks after plaster immobilisation, the cast was removed, and the patient was instructed to perform forearm rotation exercises, elbow joint flexion, and extension functional training. Six months after surgery, X-ray reexamination showed satisfactory healing of the ulnar osteotomy ends and satisfactory humeroulnar alignment. After removing the internal fixation, no recurrence of humeral head dislocation was observed (see **Figure 4**). The child's elbow joint flexion, extension, and forearm rotation functions recovered well.

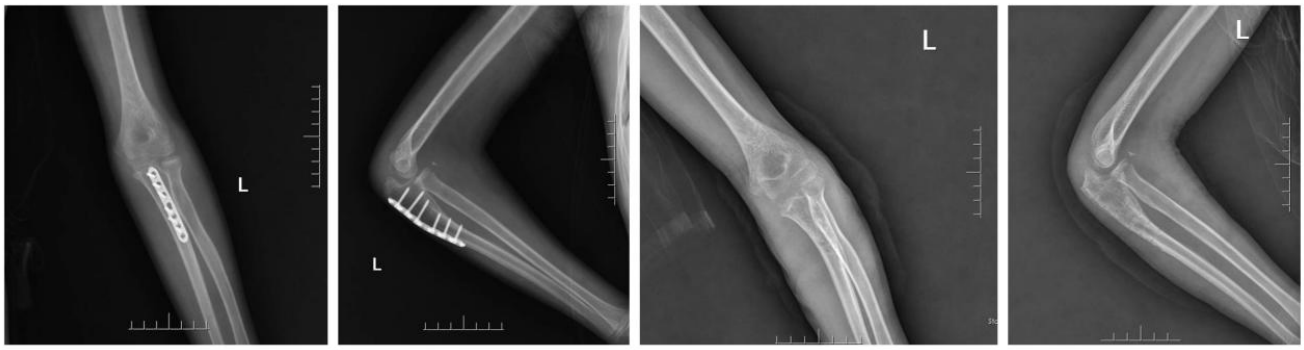

Figure 4. Radiographic confirmation of ulnar union and stable joint alignment after internal fixation removal.

Figure 4 shows satisfactory healing of the ulnar osteotomy ends and satisfactory humeroulnar joint alignment six months after surgery. After removing the internal fixation, excellent humeroulnar joint alignment was maintained on reexamination.

3. Discussion

Monteggia fractures in children were first reported in 1814 by Monteggia, an Italian surgical pathologist from Milan. He described the injury as an ulnar fracture combined with a radial head dislocation and named it Monteggia fracture [1]. According to historical research, the understanding of Monteggia fractures has gradually developed. This type of injury is common in skeletally immature minors, especially children aged 4–10 years. Although numerous scholars have conducted in-depth research on the injury mechanism, classification, diagnosis, treatment, and complications of Monteggia fractures, they still pose a challenge for orthopedic surgeons. In 1943, Watson-Jones noted that Monteggia fractures present more challenges than any other type of fracture. He emphasized that no other injury is as complex to manage, and treatment failures are more common with Monteggia fractures compared to other fracture types. However, the early symptoms of chronic Monteggia fractures are less typical and easily missed. Chronic Monteggia fractures cause persistent abnormalities in the elbow joint structure, potentially leading to elbow pain, limited movement, cubitus valgus, and ulnar neuritis [2]. The surgical determination and treatment of chronic Monteggia fractures are far more complex than acute injuries.

Type I Monteggia fracture is the most common type of Monteggia injury. Its mechanism mainly includes direct violence, excessive rotation, and hyperextension theories. Based on the patient's ulnar fracture type and body position at the time of injury, the injury mechanism was speculated to be a hyperextension injury. When the patient fell, the forearm was extended, and the elbow joint was hyperextended. Under the action of the biceps brachii, the radius first dislocated anteriorly, forcing it to leave the humeral capitellum. Simultaneously, the body

weight acted on the ulna, and the ulna could not withstand the longitudinal violence of the body weight, resulting in a green-stick fracture of the ulnar shaft [3]. (The injury mechanism is shown in **Figure 5**.)

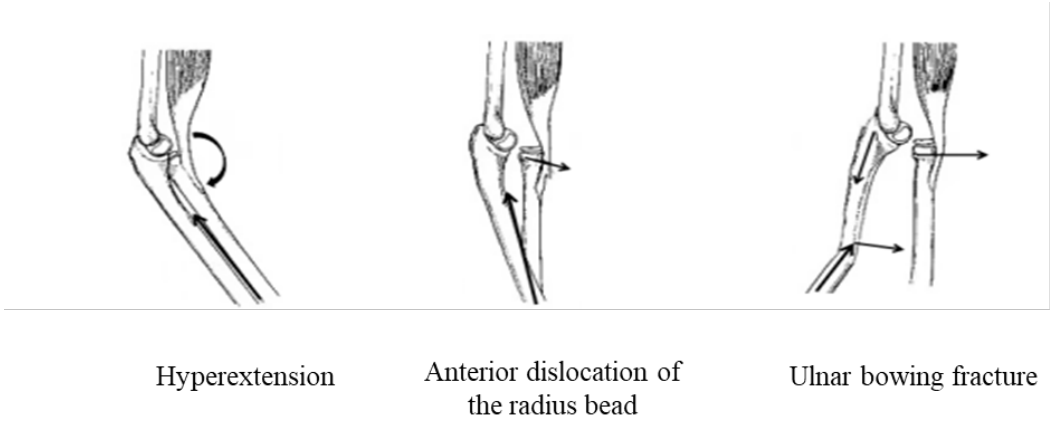

Figure 5. Schematic of the injury sequence.

Monteggia fractures in children are often misdiagnosed or missed due to various factors. First, the clinical symptoms primarily manifest as soft tissue injuries of the forearm, and primary care physicians may have a limited understanding of the injury mechanisms and characteristics specific to pediatric Monteggia fractures. Additionally, children may struggle to accurately describe the location of their pain or cooperate during physical examinations, leading to unclear descriptions of the injury details. Furthermore, radiographic imaging may not include the elbow joint, contributing to misdiagnosis or missed diagnosis. As a result, the rate of missed diagnoses in pediatric Monteggia fractures is relatively high. If prompt treatment is not provided for acute Monteggia fractures, prolonged dislocation of the radial head can gradually evolve into chronic Monteggia fractures. As the condition progresses over time, continuous changes occur in the soft tissue structures within the elbow joint, resulting in complications such as deformity healing of the ulnar fracture ends, persistent radial head dislocation, interosseous membrane contracture, nerve paralysis, and heterotopic ossification of the elbow joint [4]. These complications pose significant challenges for subsequent treatment.

With the increasing attention given to chronic Monteggia fractures, diagnostic and treatment methods have undergone innovation and improvement. Researchers have summarized existing literature to analyze the progress in treating chronic Monteggia fractures, providing a basis for diagnosis and treatment. For timely diagnosed Monteggia fractures still in the early acute stage, many scholars recommend closed reduction and plaster fixation treatment. This is because most acute Monteggia fractures achieve stable humeroradial joints after successful reduction. However, for patients with failed manual reduction and a longer disease course, the pathological characteristics align with chronic Monteggia fractures [5]. Persistent, long-term dislocation of the radial head in children is one of the main manifestations of chronic Monteggia fractures. Researchers have observed in clinical practice that many children's daily elbow joint function is not significantly affected by radial head dislocation, leading to reduced vigilance among patients and their families due to the minimal restriction in elbow joint functional activity. However, as time progresses and the disease course persists, complications emerge, including increased instability of the proximal radioulnar joint, joint degeneration, healing of ulnar deformity, osteoarthritis, and ulnar neuritis. Therefore, even if elbow joint function is essentially unrestricted in children with chronic Monteggia fractures, early surgical treatment is still recommended to prevent numerous complications later on.

The purpose of treating chronic Monteggia fractures in children is to restore the stability of the proximal radioulnar joint and improve elbow joint function by reducing the radial head. Currently, there are numerous treatment options reported in the literature, but no consensus has been reached. Treatment methods mainly focus on radial head reduction, annular ligament repair and reconstruction, elbow joint release, joint capsule scar debridement, ulnar osteotomy, adjusting the direction and length of the ulnar osteotomy end, internal fixation or external fixation, and other issues [6,7]. Some scholars believe that the annular ligament is the foundation for ensuring the stability of the proximal radioulnar joint, so the annular ligament should be routinely reconstructed. Other scholars believe that one-stage ulnar osteotomy with plate internal fixation combined with elbow joint release, annular ligament cerclage, and joint capsule reconstruction can achieve satisfactory results, and early functional exercise can be performed postoperatively, avoiding the inconvenience of external fixator care [8]. Eevi et al. showed that the stability of the radial head mainly depends on the posterior angulation and elongation obtained after ulnar osteotomy, and annular ligament reconstruction is not necessary [9]. Langenberg et al. pointed out that improper annular ligament reconstruction may adversely affect the later development of the radial head and the stability of the proximal radioulnar joint [10]. Numerous studies have shown that ulnar osteotomy and elongation are crucial steps in the treatment of chronic Monteggia fractures. Due to the good blood supply at the metaphyseal end of the ulna, it has strong healing abilities. In addition, osteotomy at the proximal ulna helps to keep the original interosseous membrane tension as high as possible. This gives the proximal radioulnar joint and the humeroradial joint even more stability after reduction. Therefore, an ulnar osteotomy is performed at the proximal end. After the osteotomy is completed, the radial head can be reduced to the correct position by using a large osteotomy angle and the tension of the interosseous membrane.

4. Conclusion

Ulnar osteotomy is an effective treatment for Monteggia fractures in children [11]. In this case, favorable therapeutic effects were achieved through a simple proximal ulnar osteotomy. Early diagnosis of Monteggia fractures in children is critical for avoiding chronic fractures and reducing subsequent complications. In clinical practice, doctors need to pay more attention to the diagnosis and treatment of fractures in children, improve their understanding of Monteggia fractures, and develop personalized treatment plans based on the specific conditions of the child. In this patient, we performed a simple proximal ulnar lengthening osteotomy with plate internal fixation. An intraoperative fluoroscopy confirmed a good reduction of the radial head. A postoperative radial head subluxation was found, which was improved by pronation of the forearm and increasing the elbow flexion angle to improve the alignment of the humeroradial joint. Six months postoperatively, good healing of the ulnar osteotomy site and good humeroradial alignment were observed. After the internal fixation was removed, good humeroradial alignment was maintained, resulting in favorable therapeutic effects. The limitation of this study lies in the small sample size, requiring further expansion of the sample size for more in-depth research and validation.

Disclosure statement

The authors declare no conflict of interest.

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